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RELATIONSHIPS OF FORMATION OF NANOPOROUS ALUMINA FILMS ON ALUMINUM IN SOLUTION OF SULPHOSALICYLIC ACID

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ABSTRACT

This work presents the results studying the volume expansion factor of nanoporous alumina films, formed by through anodizing of an aluminum foil of 11.5 μm thickness in a 0.6M sulphosalicylic acid solution. Temperature of the process was 22 °C. The model was prepared with using of photolithography. The thickness of porous alumina films was measured by a mechanical profilometer with a computer signal-processing. The volume expansion factor of porous alumina films in the range of anodizing current densities of 1.0 – 60 mA cm^{-2} varied from 1.23 to 1.64.

The obtained results demonstrated linear dependence for the current density logarithm versus the inverse volume expansion factor. The curve on this plot was found to be consisted of two subsequential rectilinear regions. We suggested that the change in the film oxide growth is the evidence of modification of the structure of Helmholtz layer in the sulphosalicylic acid electrolyte with increasing of anodizing current.

Index Terms – Alumina films, volume expansion factor

CONCLUSIONS

Our results show a linear character of ionic current density logarithm vs. reciprocal volume expansion factor regularity in galvanostatic regime of anodizing. Current density logarithm vs. reciprocal factor of volume expansion regularity has two linear regions for sulphosalicylic acid. Angle of slope of linear regularity in the second region is twice as many of first region slope.

The beginning of rapid growth of anodic current in the sulphosalicylic acid corresponds to value of 7 mA cm^{-2}.

The character of curve ln(j) = f(1/k) (Fig. 1) is the evidence of modification of the structure of Helmholtz layer (on the interface of oxide layer) in the sulphosalicylic acid electrolyte with increasing of anodizing current.

Comparison of growing of porous alumina films in the sulphosalicylic acid electrolyte on the one hand and in the sulphuric/oxalic acid electrolyte on the other hand reveals their such common relationships as the linear character of current dependences in coordinates [ln(j) vs. 1/k] and independence of angle of slope on applying acid.

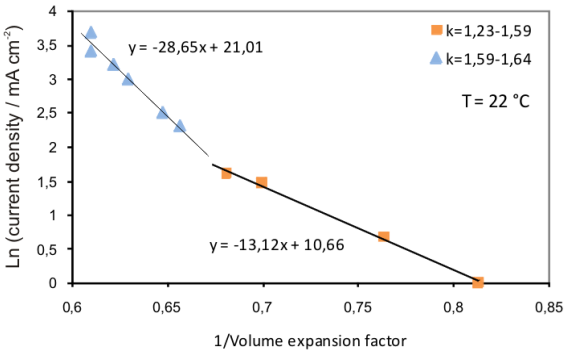

Figure 1 Dependence of current density logarithm versus the inverse volume expansion factor

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